THE AMERICAN MINERALOGIST
JOURNAL OF THE MINERALOGICAL SOCIETY OF AMERICA

Vol. 8 AUGUST, 1923 No. 8

CUBANITE: IDENTITY WITH CHALMERSITE; MAGNETIC PROPERTIES.

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The original cuban(ite), from southeastern Cuba, was characterized by Breithaupt[1] in 1843 as a massive, light yellow opaque mineral with distinct cubical cleavage, hardness 5, density 4.026-4.042 and containing about 19 per cent copper. When later analyzed (1845) by Scheidhauer the formula $CuFe_2S_3$ was obtained.[2] For density determination, and presumably for analysis, carefully selected fragments were used. Color differences were recognized between the cubanite and associated pyrite, pyrrhotite and chalcopyrite. About 1854, analyses of specimens from Barracanao, Cuba, supposedly the locality of the cubanite, were made,[3] but no descriptions which definitely identify the material with cubanite are recorded. The analyses and densities are not closely those of cubanite.

Several years later material similar to cubanite in cleavage (or parting), color, hardness (about 4), density, composition and association was described from two localities in Sweden.[4] Still later (1895) a specimen resembling cubanite, in the Berlin University collection, agreed in composition with cubanite.[5]

Recently several museum specimens which were labeled cubanite, but which were not definitely tested by the above criteria, were found to be inhomogeneous when examined microscopically on polished surfaces.[6] These observations tended to discredit the previous work on cubanite.

[1] *Pogg. Ann.*, **59**, 325, 1843.

[2] *Pogg. Ann.*, **64**, 280, 1845.

[3] Reported in Dana's System of Mineralogy, and *Am. J. Sci.*, **18**, 381, 1854.

[4] P. T. Cleve, *Geol. För. Förh.*, **1**, 105, 1873; H. Sjögren, *Z. Kryst.*, **7**, 116, 1883.

[5] Robert Schneider, *J. prakt. Chem.*, **52**, 555, 1895.

[6] Joseph Murdock, Microscopic Determination of Opaque Minerals, *New York*, 1916, p. 37. Murdock, p. 8, cites opinion of M. Leo that cubanite is a mixture.

In 1902 Hussak[7] proposed the name chalmersite for some small, well-defined, opaque, light yellow, strongly magnetic crystals from Brazil. Unsatisfactory determinations of density and composition were made. A later analysis[8] gave the cubanite formula, but the agreement was not noticed. More complete measurements were made by Palache,[9] and some of the same crystals were polished and studied by Murdock, who reported lighter color and greater hardness than chalcopyrite.[10]

During work in Alaska in 1912 on some fine-grained copper ores Johnson[11] was able to distinguish a mineral which could not then be identified. His later studies[12] including comparisons of the material with the Brazilian crystals with respect to composition, density, hardness, magnetic power and behavior of polished surfaces led to the conclusion that the two were identical. However, no cleavage had been observed in the Brazilian mineral corresponding to the decided cleavage in the mineral from Alaska.

In all the several respects in which comparison of the Alaskan mineral with cubanite can now be made they are identical. In the same respects (with the possible exception of cleavage) and in magnetic power the Alaskan mineral is identical with the Brazilian chalmersite. Thus the identity of chalmersite with the previously described cubanite may be considered established.

One other point of similarity between the Brazilian crystals and cubanite has just been found. During a magnetic test one of the Brazilian crystals broke squarely along the base, thus indicating at least one good cleavage. Also in the following paragraphs some more definite relationships between the Alaskan mineral and chalmersite are shown.

Discussion. Both Breithaupt and Sjögren[4] state that massive cubanite breaks into cubical pieces. This, however, does not necessitate the inference that cubanite is isometric. The Brazilian crystals are orthorhombic; if they were not so small and rare two other pinacoidal cleavages might be looked for in them. Breithaupt gives the hardness of cubanite as that of feldspar, 5, Sjögren says it is about 4, while Hussak[7] gives 3.5 for chalmersite.

[7] *Centr. Min. Geol.*, 69, 1902.

[8] *Centr. Min. Geol.*, 332, 1906.

[9] *Am. J. Sci.*, **24**, 255, 1907.

[10] Joseph Murdock, Microscopic Determination of Opaque Minerals, p. 72.

[11] *U. S. Geol. Survey, Bull.* 542, 101-3, 110, 112, 120, 1913.

[12] *Econ. Geol.*, **12**, 519, 1917.

However, Murdock says that chalmersite is harder than chalcopyrite, which he gives as 3.5-4.0. Hardness is so indefinite a property even when determined under conditions that are as nearly as possible comparable, that different values may be expected by different methods. On polished sections near the boundaries between harder and softer grains, the harder grains are convex and the softer concave. Thus, with vertical illumination and not too high magnification, when the objective is raised from sharp focus the borders of softer grains are more strongly illuminated. The reverse effect obtains when the objective is lowered.[13] By this means chalcopyrite was found to be softer than the Alaskan cubanite.

MAGNETIC OBSERVATIONS.[14] In separating, magnetically and with heavy solutions, the Alaskan cubanite from the associated ore minerals, pyrrhotite was found to contaminate slightly the most magnetic, and chalcopyrite the least magnetic portions of the concentrate, but there was a surprisingly large range of fractions which were alike in density and composition but different magnetically. This behavior could be accounted for by assuming that the cubanite has a very elongate magnetic ellipsoid, and that only those grains which jumped farthest were parts of single crystals, the others being aggregates of variously oriented crystals.

Two tests of this hypothesis were made: (1) one of the least magnetic portions was more finely powdered. Much of this then jumped from considerably greater distances. (2) Portions of the most magnetic material and of the least were made into disc shaped aggregates of the same size with equal amounts of paraffine, then the distances the discs would move were found to be approximately equal. Both tests thus support the theory in a substantially quantitative way.

One of the Brazilian crystals measured by Professor Palache and kindly loaned to us was suitable for magnetic investigation. Tests showed conclusively that it possessed one axis, *a*, of high magnetic susceptibility, and that along the other two crystallographic axes its susceptibility was very weak. Also it jumped toward the magnet from practically the same distance as the most magnetic of the grains of Alaskan cubanite. All other known strongly magnetic substances possess at least two axes of high susceptibility.

[13] Murdock used a method of inclined illumination. Ref. 6, p. 30.

[14] Details of the magnetic tests are not suitable for publication here.

SUMMARY. Cubanite as described from such typical localities as southeastern Cuba, also Tunaberg and Kafveltorp in Sweden, is compared with chalmersite from Brazil and Alaska. In all respects in which these minerals have been adequately described they are identical. Cubanite is the older name. Cubanite is unique among known strongly magnetic substances in having only one axis of high magnetic susceptibility.

EUHEDRAL MAGNESITE CRYSTALS FROM SAN JOSE, CALIFORNIA

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In this country magnesite has been found in two fairly distinct varieties: (1) the compact white or so-called amorphous variety, which is really microcrystalline, a fairly common mineral in the serpentines of California, and (2) the distinctly crystalline or cleavable variety, which occurs in abundance in Stevens County, Washington, as a replacement of dolomitic limestone.

A somewhat different cleavable variety occurs in the San Juan quicksilver mine (now abandoned), five miles south of the city of San Jose, Santa Clara County, California. Here the magnesite occurs in veins in an alteration product of serpentine, which consists largely of opal and magnesite with small amounts of cinnabar and pyrite and a little residual antigorite. A microscopic examination of a thin section shows that the magnesite had replaced the opal and the opal in turn had replaced the antigorite of serpentine. The serpentine is doubtless an alteration product of peridotite.

The veins of magnesite are from 1 to 10 cm. in width and show a more or less banded structure. The magnesite is colorless to pale amber-colored with cleavage surfaces up to 5 mm. in size. In appearance it resembles dolomite, but chemical tests show only a small amount of calcium. The specific gravity determined on about 4 g. of carefully selected material is 3.052. Quartz, chalcedony, and occasionally a little bitumen are found directly associated with the magnesite.

In cavities the magnesite is found in distinct euhedral crystals. The exceeding rarity of crystallized magnesite accounts for the present note. As far as can be ascertained, magnesite crystals have never been described from the United States before; in fact, there are records of only seven or eight occurrences taken the world over.

The crystals from the San Juan mine measure from about 1 mm. up to 7 or 8 mm. in longest dimension. The dominant forms are the scalenohedron *V*$(21\bar{3}1)$ and pinacoid *c*(0001), which are modified by the prism *a*$(11\bar{2}0)$ and very narrow faces of the rhombohedron *f*$(02\bar{2}1)$. Fig. 1, which was kindly drawn for me by Miss Lillian M. Dobbel, represents a crystal in ideal development, but the crystals are usually so attached that only the polar edges of the scalenohedron are visible. It was, in fact, some time before the prism faces were recognized.

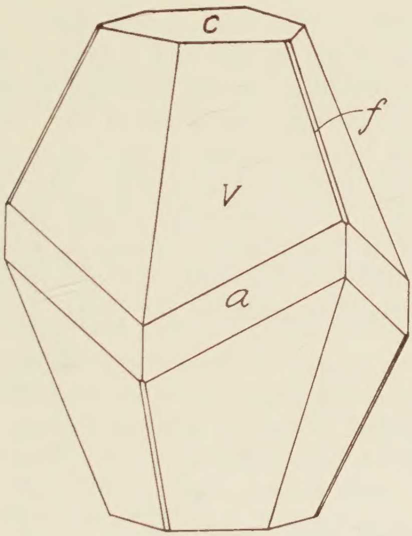

FIG. 1. MAGNESITE CRYSTAL FROM THE SAN JUAN MINE, SAN JOSE, CALIFORNIA

As the faces of the crystals are dull, the scalenohedron *V*$(21\bar{3}1)$ was identified by the following measurements made on the stage of a polarizing microscope: *VV*$(21\bar{3}1:\bar{2}3\bar{1}1)$ = 74° (calc. value = 74° 46′); *VV*$(21\bar{3}1:3\bar{1}\bar{2}1)$ = 35° (calc. value = 35°20½′). The rhombohedron *f*$(02\bar{2}1)$ and the prism *a*$(11\bar{2}0)$ were identified by the fact that faces of these forms truncate respectively the short polar and lateral edges of the scalenohedron. The angle $(10\bar{1}1:\bar{1}101)$ of a cleavage rhomohedron was measured on a reflection goniometer and found to be 72°42′, which agrees well with Koksharov's value of 72°36′.

That the mineral described in this article is magnesite is definitely proved by the following chemical analysis, which was made by Mr. K. S. Boynton.

ANALYSIS OF MAGNESITE FROM THE SAN JUAN MINE, SAN JOSE, CALIFORNIA.
K. S. BOYNTON, ANALYST.

	Analysis	Theory for $MgCO_3$
MgO	46.26	47.62
CaO	1.74	......
FeO	1.27	......
CO_2	50.48	52.38
H_2O	nil.	......
Insol.	nil.	......
Total	99.75	100.00

The mineral used for this analysis was the cleavable material of the veins, but it grades into and is exactly like the cleavage fragments of the euhedral crystals described above.

In cleavage fragments, two values of the index of refraction were determined by the immersion method in comparison with liquids of known indices of refraction. One of these values $n_\gamma = 1.704 \pm .001$. The other value, which may be designated $n_x = 1.599 \pm .001$, is intermediate between n_γ and n_α, as may be seen from Fig. 2 which represents two orthographic projections of a cleavage fragment made on the $(10\bar{1}1)$ and $(\bar{1}2\bar{1}0)$ planes.

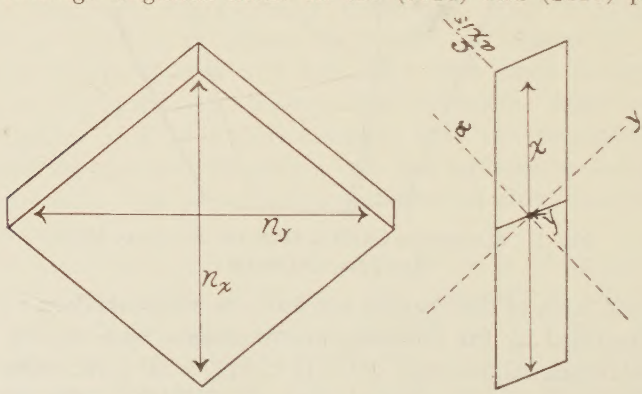

FIG. 2. OPTICAL RELATIONS IN CLEAVAGE FRAGMENTS OF MAGNESITE (AND OTHER RHOMBOHEDRAL CARBONATES)

(The drawings are orthographic projections made on planes at right angles to each other. In these drawings α, x, γ are directions and $n\alpha$, n_x, and $n\gamma$ are the indices of refraction for these directions.)

In the determination of the rhombohedral carbonate minerals, this intermediate value n_x is more important than n_α, which is obtained with difficulty, and it would seem advisable to include it in future descriptions of these minerals.

SOME EFFECTS OF HEAT ON THE PROPERTIES OF MINERALS[1]

JOHN T. LONSDALE, *University of Virginia*

On January 27, 1917, fire destroyed the Chemical Laboratory at the University of Virginia, Charlottesville, Virginia. A collection of minerals, belonging to J. W. Mallet, late Professor of Chemistry at the University, stored in the building at the time, was exposed to the direct action of the fire. After the fire the remains of the collection were examined in an attempt to recover some of the more valuable specimens, which included twenty-four diamonds and other rare species. The attempt to recover the diamonds having proved a failure, the salvage was stored until the present time.

The effect of heat upon many of the minerals which constitute the building stones is well known. In regard to the less common minerals, including some of the ore minerals, these data are known only in their application to blowpipe analysis and as applied to very small specimens or to the powder of the mineral. It was thought that the phenomena produced in this collection of minerals might show features not emphasized in the customary blowpipe practice. The collection contained specimens of all sizes from small individual crystals to large masses of material weighing several kilos. Furthermore since the fire lasted for several hours, the heat was applied for a longer period than is customary in producing the reactions obtained in determinative work.

The temperature of the fire is believed to have been approximately 940 degrees Centigrade. Large masses of brass were entirely unaffected by the heat but glass was fused into globular forms. Similarly, silver in wires was fused into globules but copper was unaffected. It is assumed that the temperature was fairly uniform but it must be remembered that there was necessarily some slight variation from place to place, as shown by the examples .given. Certain areas of the burning building were more protected than others and the temperature varied accordingly.

[1] The writer's attention was called to the collection by Dr. Thomas L. Watson, who suggested that a study of the "burned" material might reveal interesting and valuable data on the effect of heat on the properties of minerals. Dr. Watson also gave many valuable suggestions during the course of the investigation.

The procedure of the study was to consider each specimen known to have gone through the fire and to determine its mineral nature, original appearance and the changes produced by the fire. As far as possible the original appearance of the mineral was determined from the mineral itself. In some cases even the interior of the specimen was so changed that its original appearance could not be described. Only cases in which the identification was certain and the original appearance apparent, in the specimen itself, are considered here.

Considerable difficulty was experienced in separating the effect of weathering from that of heat. The collection had been exposed, for a long time, to the action of the weather. Certain minerals, such as those of copper, showed extensive alteration probably caused by weathering and not by the heat. Many specimens were entirely decomposed by the action of the fire and could not be identified. The most durable minerals or those least affected by the fire were the ones determined. Fifty species were positively identified and their changes recorded. The results are tabulated below.

Original Material	Burned Material
(1) Antimony. An ore specimen 2″×2″×1″ with scattered grains of metallic antimony. Individual grains less than one-eighth inch in greatest dimension.	Surface of burned material showed accumulation of globular bodies of metallic antimony some larger than ¼″ in diameter. These show that the mineral melted and that the melted part solidified on the surface of the specimen. The interior of the specimen was unaffected.
(2) Silver. Shreds and masses of wire silver in limestone. Single groups of wires up to ½″ long.	Exposed surfaces and points of the silver were fused to globules but some points were unaffected. At this place the temperature must have been very close to 960 degrees Centigrade.
(3) Copper. Zeolitic copper ore showing abundant native copper and cuprite in basalt, 3″×3″×2″.	Neither copper nor cuprite were affected by the fire. Malachite was well developed but probably through weathering.
(4) Tetradymite. A pure specimen of massive tetradymite, 3″×3″×3″, silvery white in color, slightly sectile and very soft.	The surfaces of the burned material were fused with escape of gas bubbles as shown by hollow globular bodies. Surface showed greenish earthy appearance but the interior was unaltered.

Original Material (continued)	Burned Material (continued)
	The surface made harder and more brittle than interior. Films of metallic bismuth were developed along cracks in the mineral.
(5) Galena. Cubes of the mineral up to $\frac{1}{2}''$ square.	Luster of surface dulled and rendered non-metallic. This effect extended inward less than one-eighth inch.
(6) Chalcocite. Specimen of pure metallic material $3\frac{1}{2}'' \times 2\frac{1}{2}'' \times 2''$.	Changed in color to dark grayish to greenish resembling furnace slag. Interior was made porous and vesicular with many bubble holes. Color of fresh surface differed from typical chalcocite in that it had lost gray tint and had become earthy. Pores and openings occupied by metallic copper.
(7) Pyrrhotite. Massive material of typical color, $2\frac{1}{2}'' \times 2'' \times 2''$.	Color was changed, in places from bronze to bluish black. Specimen was rendered slightly more brittle.
(8) Bornite. Pure, massive material $2'' \times 1\frac{1}{2}'' \times \frac{1}{2}''$.	Surface of burned material exhibited a dull non-metallic appearance with a dark earthy green color. Interior of specimen was fresh and metallic in appearance.
(9) Chalcopyrite. Impure material $3'' \times 3'' \times 3''$.	The burned material showed a powdery green surface with an earthy appearance. The interior was unaltered. There was no evidence of fusion or development of native metal.
(10) Arsenopyrite. Massive material $2'' \times 2'' \times 2''$.	The surface was blackened and oxidized with the loss of metallic luster. The interior was unaltered.
(11) Polybasite. Vein quartz with veinlets of silver minerals, cerargyrite and polybasite.	The burned material showed the quartz whitened and made friable. Surfaces carried globules of metallic silver and partly reduced silver minerals. These minerals fused and bubbled up on the surface of the quartz. Interior of specimen showed only slight fusion of the silver minerals.
(12) Cerargyrite. See (11).	See (11).

Original Material (continued)	Burned Material (continued)
(13) Fluorite. A mass of transparent crystals of fluorite, aggregating 3″×1½″×1″, with purple color, coated in places with minute grains of sulphide minerals. Crystals cubic, often grown together.	The burned material was whitish nearly opaque at places showing purple tint. Rendered exceedingly brittle being easily broken between the fingers. The sulphides were little affected.
(14) Quartz. A group of transparent crystals 5″×3″×3″ on a base of sandstone. Single crystals up to 1½″ long.	Exposed edges of burned material was rendered opaque or milky. The entire specimen was made brittle and friable being easily crushed by the fingers.
(15) Hematite. A museum specimen of crystallized specular hematite, 3″×2″×1¾″, with well developed individual crystals.	The surface was changed from brilliant metallic appearance of specularite to the dull red color of massive hematite. Minute iridescent flakes of magnetic material, resembling artificial carborundum, were developed on the surface of the specimen. The color change extended inward only a small fraction of an inch toward the center of the specimen.
(16) Ilmenite. Mass of pure material 2″×2″×1″.	Was rendered more brittle than typical material.
(17) Chromite. Pure material 4″×4″×3″.	Burned material was slightly more brittle than typical material and showed the development of a greenish oxide coating along fracture cracks.
(18) Manganite. A radial group of slender striated crystals with a botryoidal structure. Single crystals up to 2″ long, diameter of group 2½″.	In a zone extending ½″ from surface the color of the mineral was changed from black metallic to earthy brown.
(19) Calcite. A mass of vein material with crystallized calcite of yellowish color and transparent.	The mineral was made less coherent and its surface was turned white and nearly opaque. The interior of the specimen was unaffected.
(20) Cerusite. A porous mass of impure cerusite and smithsonite 3″×2½″×1″.	The surface was made black and slaggy in appearance with the development of small globules of metallic lead. The slaggy crust extends inward ¼″ where it is replaced by greenish-gray porous carbonates.

Original Material (continued)	Burned Material (continued)
(21) Garnet. Single crystal ¾″ in diameter in mica schist.	Unaffected though schist was rendered friable and incoherent.
(22) Olivene. A specimen of granular material (dunite) 2½″ in diameter.	Surface was blackened and made earthy.
(23) Andalusite. Fine crystals up to 1″ long in a matrix of milky quartz.	The fire loosened the crystals in the matrix and made the quartz incoherent.
(24) Cyanite. A mass of interlocking bladed crystals with blue color.	The specimen was made friable and the blue color was destroyed nearly to the center of the specimen.
(25) Prehnite. A crust, ½″ thick, of radiate groups of light green crystals covering a 3″×3″ surface of basalt.	Edges showed white color and swelling or intumescence. Interior unaffected.
(26) Muscovite. Crystals, ½″ across base, in matrix of quartz.	Edges and surfaces were darkened slightly.
(27) Lepidolite. A mass of minute flakes with violet color, 6″×5″×4″.	Violet color destroyed leaving specimen uniformly white.
(28) Apatite. A single prismatic crystal, without terminations, 2½″×½″, of reddish brown color.	Reddish color has been changed to gray with a tint of pink. Luster was changed from vitreous to dull. Interior of crystal unaffected.
(29) Pyromorphite. A mass of mall greenish crystals in quartz.	The center of the specimen was unaffected. The surface showed development of fused globules with gas holes. The color was changed to brown and grayish-black.
(30) Vanadinite. Massive material 6″×4″×3″.	The surface was blackened and made slag like with small globules of metallic lead. Interior showed a greenish color and a porous st ucture with many open spaces like channels. These openings were partly filled with metallic lead. The globules often showed gas holes.

Original Material (continued)	Burned Material (continued)
(31) Mimetite. Small crystals and grains in quartz.	Specimen was partly reduced as shown by globules of metallic lead on its surface. Interior was unaffected.
(32) Turquois. Fine. bluish-green material.	Color was changed to white with tint of blue. Center of specimen unaffected.
(32) Celestite. A single crystal 1″×½″×½″.	Specimen was made slightly more brittle.
(34) Gypsum (Alabaster). Pure. white. 3″×2″×2″.	The outer part of the specimen was made powdery with the development of an unctious character showing that the mineral lost water. This effect extended inward ½″.
(35) Anglesite. Magnificent crystals up to 1½″ long with typical orthorhombic development and groups of small crystals forming a felt like mass on a sulphide base.	The color was changed to dull bluish-black with the development of a submetallic luster. The smaller crystals were decomposed with the formation of metallic lead.

In addition to the minerals listed above, the following were entirely unaffected: graphite, molybdenite, niccolite, cuprite, magnetite, rutile, brookite, orthoclase, labradorite, leucite, axinite, tourmaline (black), talc, titanite, and lazulite.

A review of the above table shows that most of the changes produced, by the fire, were the ones to be expected. A few, however, seem to merit special mention. Among the most interesting were the changes in color. The following non-metallic minerals suffered a loss of their characteristic colors: fluorite, cyanite, prehnite, lepidolite, and turquois. Of these, turquois behaved in an unusual fashion. This mineral is supposed to change to a brown color upon heating but it was found, here, to assume a white color.

Other changes related to color are as follows: metallic chalcocite to earthy slag; metallic bornite to earthy material; transparent quartz to milky opaque material; metallic hematite to non-metallic; black metallic manganite to earthy brown material; transparent calcite to cloudy material; and flesh colored apatite to dull grayish material.

Several of the ore minerals suffered decomposition and the formation of the native metal. These were chalcocite, vanadinite,

pyromorphite, mimetite and anglesite. In each of these cases there is ample evidence to show that volatile constituents were liberated, for bubble holes can be observed in every case. It is of interest that chalcocite suffered decomposition while bornite and chalcopyrite did not. Gypsum was dehydrated but the temperature was not sufficient to free the carbon dioxide of calcite.

NOTE ON COBALTIFEROUS GAHNITE FROM MARYLAND[1]

EARL V. SHANNON, *U. S. National Museum*

The old copper mines of Carroll County, Maryland, are known to mineralogists as the type localities for two rare cobalt minerals, remingtonite and carrollite. The ores have, however, received little critical mineralogical examination in recent years. While on a visit to several of the mines in company with Drs. Schaller and Foshag the writer found a specimen of a deep blue mineral at the Mineral Hill mine and the same mineral was found at the Patapsco and Springfield mines by Dr. Foshag. This mineral had much the appearance of lazulite but upon optical examination it was found to be isotropic and analysis proves it to be the zinc spinel, gahnite, notable as owing its beautiful blue color to cobalt which is present in definite amount. This analysis is interesting as confirming the work of Wherry who, by microspectroscopic examination, found that distinctly blue spinels gave the absorption spectrum of cobalt.[2] Trial of a thick section of this Mineral Hill occurrence showed only a faint, hazy band, but it occupied the characteristic position in the spectrum, wave length 550.

The mineral is deep indigo blue in color and occurs as octahedral crystals up to 5 millimeters in diameter and as granular masses of smaller crystals several centimeters in diameter. The spinel, in specimens from all three mines, occurs in veins of glassy quartz up to 10 cm. in width enclosed in fine micaceous schist. In the specimen analyzed the spinel forms streaks parallel to the walls of the veins. In the specimens from both the Patapsco and

[1] Published by permission of the Secretary of the Smithsonian Institution. A preliminary paper on the Minerals of Maryland, being compiled under the auspices of the Maryland State Geological Survey.

[2] Edgar T. Wherry. The microspectroscope in mineralogy. *Smithsonian Miscellaneous Collections*, **65**, No. 5, 1915.

Mineral Hill mines the spinel is intergrown with minor amounts of magnetite and chalcopyrite.

Under the microscope the mineral analyzed is fine clear blue with a refractive index of 1.790 ±.002. The material from the Patapsco mine is about the same in color with a slightly higher index, 1.792 ±.002. Its cobalt content is probably about the same. The spinel from the Springfield mine is slightly greener in the hand specimen and under the microscope is more greenish and less deeply colored, the index being slightly lower, 1.788 ±.002. It probably contains less cobalt than the others.

The specimen from the Mineral Hill mine was analyzed. The sample was selected to contain as much spinel as possible, crushed and screened to 100 to 200 mesh and separated from quartz with methylene iodide. Magnetite was removed with a horseshoe magnet and a small amount of chalcopyrite dissolved out with nitric acid. The resulting sample was found by microscopic examination to be pure and to have a uniform refractive index. It was insoluble in hydrofluoric acid and very slowly soluble in sodium carbonate fusion. The fusion was made with potassium pyrosulphate and only 1.5% of the mineral remained undecomposed. This is tabulated as insoluble in the statement of the analysis, which gave the following results:

Analysis and Ratios of Gahnite.

	Per cent	Ratios		
Insoluble	1.50			
SiO_2	1.50			
Al_2O_3	54.50	.533	.533×1	1.00×1
FeO	4.86	.068		
MgO	.42	.010		
ZnO	34.48	.424	.528×1	.99×1
CoO	1.48	.020		
CuO	.14	.002		
MnO	.26	.004		
Total	99.14			

Owing to the insoluble character of the mineral it was not possible to determine the state of oxidation of the iron. The ratios indicate, however, that it must be entirely ferrous.

The fact that this mineral was found at all three of the mines visited would seem to indicate that it is a fairly common mineral in the ores of this zone.

PROCEEDINGS OF SOCIETIES

NEW YORK MINERALOGICAL CLUB

Annual Meeting of April 18, 1923

An annual meeting of the New York Mineralogical Club was held in the Assembly Room of the American Museum of Natural History on the evening of April 18, at 8 P. M. The President, Dr. George F. Kunz, presided and there was an attendance of 20 members.

The minutes of the last meeting were read and approved. The Treasurer submitted an annual report showing a balance of $557.20 on hand. A motion by the President that the Club contribute $25.00 to THE AMERICAN MINERALOGIST was carried. The President appointed as a committee on the Gratacap Memorial Tablet, Messrs. Whitlock, Stanton and Ashby. The Committee on Membership reported favorably on the following names which were forthwith declared elected to membership: Miss Hilda Lohr, 1082 Broad Street, Newark, N. J.; Miss Emma L. Kemp, Lincoln High School, Jersey City, N. J.; and Mr. Oliver P. Medsyer, Arlington, N. J.

The Committee on Nominations for Officers for the ensuing year recommended for reelection the following officers:-

For President	Dr. George F. Kunz
For Vice President	George E. Ashby
For Corresponding Secretary	Wallace G. Levison
For Recording Secretary	Herbert P. Whitlock
For Treasurer	Gilman S. Stanton

On motion the chairman of the Nominating Committee acting as Secretary *pro tem* cast one ballot for the above candidates who were declared elected.

The President reappointed the Committee on Program consisting of the President, the Recording Secretary, Messrs. Manchester, Wintringham, R. M. Allen, Lee, Ashby, and F. I. Allen, to arrange for a program for the coming year.

Capt. Miller introduced the question of a Committee on Excursions. After considerable discussion it was moved that the present committee on Excursions be reappointed with the addition of Mr. Charles Hoadley. On the introduction of the question of an objective for the Decoration Day excursion, the Secretary was instructed to write to Dr. J. Volney Lewis for suggestions as to localities for this field day. The Secretary was also instructed to convey to Prof. Daniel S. Martin the well wishes and esteem of the Club.

The following specimens were shown as a result of the three best specimens symposium which completed the program for the evening:-

Dr. Kunz:- Epidote from California showing dichroism. Chrysoberyl, Brazil, two twinned crystals weighing 10¼ and 11 oz. Quartz from Payette Lake, Idaho.

Mr. Walther:- Pseudogaylussite from Clyde River. Quartz pseudomorphs from Cumberland. Plumbogummite after pyromorphite, Cumberland.

Mr. Wintringham:- Labradorite and anorthoclase, apophyllite. Quartz crystal distorted and developed like topaz.

Mr. Grenzig:- Quartz from North Carolina. Calcite from Woodcliff, showing basal planes. Quartz from Niagara Co., distorted crystals.

Mr. Allen:- Carnelian scarab.

Mr. Broadwell:- Bismuth from Kingsgate, N. S. Wales. Molybdenite from Deepwater, N. S. W. Arsenopyrite from Emmaville, N. S. W.

Mr. Maynard:- Calcite in fluorite from Weardale, Eng. Fluorite from Cornwall, Eng. Calcite from Weardale, Eng.

Mr. Ashby:- Amethyst with cavities after aragonite. Capped quartz from Schlaggenwald, Bohemia, with 4 cappings each about ¼ inch thick, the complete separation being between the second and third cap. Fossil copal from near Paramaribo, Dutch Guiana, South America, and containing the pupa of insects, similar to white ants. The interesting point being that the contents of the pupa cavity is still liquid in the fossil gum.

Meeting adjourned 9.35 P. M.

HERBERT P. WHITLOCK, *Recording Secretary.*

NEW MINERALS: NEW SPECIES

CLASS: PHOSPHATES, ETC. DIVISION: $R'':U^{vi}:P:H_2O=2:1:2:1$.

Parsonsite

ALFRED SCHOEP: Sur la parsonsite, nouveau minéral radioactif. [Parsonsite, a new radioactive mineral.] *Compt. rend.*, **176**, (3) 171-173, 1923.

NAME: Dedicated to Professor A. L. *Parsons* of Toronto.

CHEMICAL PROPERTIES: Formula, regarded as probably $2PbO.UO_3.P_2O_5.H_2O$ or $Pb_2(UO_2)(PO_4)_2.H_2O$. Theory, PbO 50.0, UO_3 32.1, P_2O_5 15.9, H_2O 2.0%. Analysis on small samples purified by washing gave: PbO 44.71, CuO 0.25, CaO 0.63, Al_2O_3 1.23, UO_3 29.67, P_2O_5 15.08, TeO_3 3.01, MoO_3 0.43, CO_2 1.19, H_2O 1.56, insol. 1.51%; summation given as 99.47, but actually 99.27%. The Cu is believed to come from admixed torbernite which likewise contains Te and Mo. [Other admixture appears to be present, and it is to be hoped that the formula can be confirmed on purer material.] In the closed tube yields H_2O and becomes yellowish. On charcoal fuses to a black globule. Readily soluble in acids, leaving a slight insoluble residue and giving reactions for Pb, U, and P.

CRYSTALLOGRAPHIC PROPERTIES: Monoclinic or triclinic. Crystals very minute; habit tabular; taking the dominant form as (010), the angles are (100):(001) = 81°; (100):(*hol*) = 47-48°; (001):(*hol*) = 28-29°(?).

OPTICAL PROPERTIES: Biaxial; $n>1.99$; birefringence weak; elongation +; extinction 12°.

PHYSICAL PROPERTIES: Color, pale brown, mostly due to inclusions; streak, pale brown with rose tinge; structure earthy, minutely crystalline to compact; luster greasy; density = 6.23; radioactive.

OCCURRENCE: Associated with torbernite at Kasolo, Katanga, Belgian Congo.

DISCUSSION: Acceptable as a new species, although the data are not as complete as might be desired.

E. T. W.

CLASS: PHOSPHATES, ETC. DIVISION: $R:P:H_2O=1:1:2$.

Weinschenkite

F. HENRICH: Ueber ein neues Mineral, das seltene Erden als Hauptbestandteil enthält. (A new mineral which contains rare earths as essential constituents); with analytical data by G. HILLER and mineralogical data by H. LAUBMANN. *Edel-Erden und Erze*, 2, 181, 1921; *Ber. deutsch. chem. Ges.*, **55**, (9), 3013-3021, 1922.

NAME: Given by Dr. Laubmann after the late petrographer of Munich, Professor Ernst *Weinschenk.*

CHEMICAL PROPERTIES: Formula, $(Y,Er)(PO_4)(H_2O)_2$ with Y:Er = 5:1. Theory: R_2O_3 54.1, P_2O_5 30.5, H_2O 15.4, sum 100.0%. Analysis gave: R_2O_3 52.47, P_2O_5 30.20, Fe_2O_3 0.24, insol. 0.38, loss on ign. 16.42, sum 99.71%. Mean atomic weight of rare earths (R) = 102; methods of analysis are described in detail; small amounts of other rare earths are present.

In the closed tube yields water, but no fluorine. Infusible; heated with cobalt solution becomes dark. Readily soluble in dilute acids, but not in alkalies.

PHYSICAL PROPERTIES: Color white; form, matted globular masses, also radiated needles. Closely resembling wavellite, but found by Laubmann to be optically distinct (no data given).

OCCURRENCE: As a coating on limonite iron ores in the Amberg-Auerbach mine, Bavaria. An associated mineral containing much less rare earths is called by Dr. Laubmann "pseudo-wavellite."

REMARKS: Evidently a new species, although the incomplete description is to be regretted. E. T. W.

CLASS: PHOSPHATES, ETC. DIVISION: $R'':R''':P:H_2O = 4:4:6:27.$(?).

Vauxite

S. G. GORDON: See *Am. Min.*, **7**, (6), 108, 1922; *Science*, **56**, 50, 1922.

CLASS: PHOSPHATES, ETC. DIVISION: $R'':R''':P:H_2O = 1:2:2:11.$(?).

Paravauxite

S. G. GORDON: *loc. cit.* E. T. W.

ABSTRACTS: CRYSTALLOGRAPHY

THE OPTICAL PROPERTIES OF EPIDOTE. M. GOLDSCHLAG. *Tscher. Min. Petr. Mitt.*, **34**, 23-60, 1917; through *Mineralog. Absts.*, **1**, 346.

The following minerals were examined: (I)Clinozoisite, wine-yellow crystals from the Schwarzenstein Alp, Zillerthal, Tyrol; (II)Olive-green epidote from Pfarrerb, Zöptau, Moravia; (III)Pistachio-green epidote from the Knappenwand, Sulzbachthal, Salzburg; (IV)Deep-green pistazite from Rauhbeerstein, Zöptau. The results were:

	Iron-epidote molecule	α	β	γ	2V (over α)	$a:c$
I.	0%	1.7136	1.7172	1.7188	113°47′	+12°17′
II.	22	1.7217	1.7422	1.7500	80 15	− 2 05
III.	34	1.7262	1.7569	1.7737	73 06	− 4 28
IV.	37	1.7291	1.7634	1.7796	68 53	− 4 53

These and others from the literature are tabulated to show the variation of optical properties (Na light) with the amount of the iron-epidote molecule. E. F. H.

THE BINNENTHAL DOLOMITE, ITS CRYSTAL FORMS, INDICES OF REFRACTION, AND ETCH PHENOMENA. PAUL KOLLER. *Neues Jahrb. Min. Geol.*, Beil.-Bd. **42**, 457-98, 1918; through *Mineralog. Absts.* **1**, 350.

Four types of crystals are described. On the colorless transparent crystals 35 forms are noted. Striations, etch figures, and several third order rhombohedrons show the symmetry. For crystals with $FeCO_3 = 0.09$-0.13%, the indices were: ω_ρ 1.6733, ω_{Na} 1.6799, ω_ν 1.7030, ϵ_ρ 1.4984, ϵ_{Na} 1.5013, ϵ_ν 1.5110. Sp. gr. 2.882.

Etch-figures on the cleavage of magnesite show the same symmetry as those of calcite, but in reversed position. E. F. H.

CRYSTAL GROWTH AND CHEMICAL AFFINITY. J. J. P. VALENTON. *Physik. Z.*, **21**, 606-9, 1920.

The assumption is made that atoms in undissociated molecules and in crystals possess residual electrostatic charges. Therefore, the atoms in the outer layer of a growing crystal exert an effect into the solution, attracting atoms of unlike sign and repelling those of like sign. The cube faces of NaCl have both + and – atoms arranged in checkerboard fashion. Midway between the atoms the field is neutral. The growth normal to these faces should be slow. The (111) faces represent an opposite extreme for all atoms in any one net plane have the same kind of charge and there is no neutral field. Normals to these faces should be directions of rapid growth. Prominent crystal faces are those of slow growth, hence cubes are common for NaCl. OTTO VON SCHLICHTEN

IS THE MANNER OF ATTACHMENT OF A CRYSTAL TO ITS SUPPORT DETERMINED BY SOME LAW, OR IS IT ACCIDENTAL? GEORGE KALB. *Centralbl. Min.*, 65-67, **1920**.

K. presents a tabulation of the mode of attachment of a series of minerals to their support, data taken from current textbooks on mineralogy. The fact is brought out that needle-shaped, bladed and prismatic crystals are attached with their longer dimension normal to their support, while platy crystals are attached by an edge. This is true even if the support is non-crystalline. K. concludes: (1) that "crystals have a tendency to attach themselves to their supports so that a predominating rational direction is normal to the support." NaCl crystallizes from an aqueous solution in cubes which are attached to the sides and bottom of the vessel by their cube faces. Crystallizing, however, from a NaOH solution the cubes are so attached that a trigonal axis stands normal to the support. (2.) "The plane of attachment is a crystal face having a high surface tension." (3.) "Crystals that are permitted to grow undisturbed assume a position of equilibrium with respect to their support, which is determined by their surface tension.

OTTO VON SCHLICHTEN

ON THE OCCURRENCE OF COTUNNITE, ANGLESITE, LEADHILLITE, AND GALENA ON FUSED LEAD FROM THE WRECK OF THE FIRE-SHIP 'FIREBRAND' IN FALMOUTH HARBOUR, CORNWALL. ARTHUR RUSSELL. *Mineral. Mag.*, **19**, (90), 64-68, 1920.

Numerous well developed crystals were found on the surface and in the interstices of cavernous masses of metallic lead. *Cotunnite* ($PbCl_2$); the crystals which are up to 3 mm. in length are generally elongated parallel to the *a* axis. No evidence of twinning was detected. The following eight forms were observed: (010); (001); (021); (011); (012); (101); (111); (112). *Anglesite;* these were rectangular in habit, colorless to black, and attained a length of 5½ mm. The forms noted were: (100); (001); (110); (011); (102); (122); (113). *Leadhillite;* forms thin, six sided plates with a diam. of about 1 mm. In most cases the images were poor but 8 forms were positively identified; (101); (201); (101); ($\bar{2}$01); (112); (111); ($\bar{1}$12); ($\bar{1}$11). W. F. H.